WHAT IS CLAIMED IS:

1. A biosensor for concentrating and detecting living microorganisms in a macroscopic sample in a minimal time, comprising:

a substrate;

a detection chamber disposed on said substrate and defining a volume between 1 pico-liter and 1 micro-liter, said detection chamber adapted to confine a composition containing microorganisms;

specimen concentration means connected to said detection chamber for rapidly concentrating said microorganisms in said detection chamber;

a heater operatively connected to said substrate to heat said composition in said detection chamber; and

electrodes mounted on said substrate in communication with said detection chamber to identify AC impedance changes within said detection chamber from bacterial metabolism of said microorganisms of said composition over time.

2. The biosensor of claim 1 wherein said detection chamber confines said first composition containing between 1 to 1000 microorganisms.

3. The biosensor of claim 1 wherein said specimen concentration means include a branching channel structure and a retention device at said detection chamber for capturing said microorganisms from a sample stream flowing in said channel structure, said channel structure including a large inflow groove or trench and a substantially smaller channel extending from said inflow groove or trench to said detection chamber.

4. The biosensor of claim 3 wherein said retention device has magnetic and/or electrical attributes to confine said microorganisms.

5. The biosensor of claim 3 wherein said retention device has electrodes including interdigitated finger parts for generating a non-uniform electric field to confine said microorganisms.

6. The biosensor of claim 5 wherein said retention device generates said non-uniform electric field periodically to confine said microorganisms at the surface of said detection chamber.

7. The biosensor of claim 3 wherein said retention device has mechanical attributes to confine said microorganisms.

8. The biosensor of claim 1 wherein said heater maintains said composition within said detection chamber to a temperature of within 0.1°C of a selected temperature value.

9. The biosensor of claim 1 wherein said heater applies heat to said detection chamber for several hours to stimulate microorganism metabolism.

10. The biosensor of claim 1 wherein said electrodes sample AC electrical impedance at one selected frequency between 10 Hz and 1 MHz.

11. The biosensor of claim 1 wherein said electrodes sample AC electrical impedance at more than one selected frequencies between 10 Hz and 1 MHz.

12. The biosensor of claim 1 wherein said electrodes generate impedance data as a function of AC electrical frequency.

13. The biosensor of claim 1 wherein said electrodes generate impedance phasor signals.

14. The biosensor of claim 12 in combination with a computation device to compare impedance magnitude data from said detection chamber to impedance data from said detection chamber at different times and thereby identify bacterial metabolism within said first composition of said detection chamber.

15. The biosensor of claim 12 in combination with a computation device to compare impedance phase angle data from said detection chamber to impedance data from said detection chamber at different times and thereby identify bacterial metabolism within said first composition of said detection chamber.

16. The biosensor of claim 13 in combination with a computation device to process said impedance phasor signals to identify bacterial metabolism within said composition of said detection chamber.

17. The biosensor of claim 1 wherein said electrodes have an interdigitated spacing within said detection chamber to gather bulk impedance measurements.

18. The biosensor of claim 1 wherein said electrodes are mounted on said substrate in communication with said detection chamber to identify AC impedance changes within said detection chamber from bacterial metabolism of said microorganisms of said composition over time relative to previous AC impedance values associated with said composition.

19. A biosensor for concentrating and rapidly detecting living microorganisms in a macroscopic sample, comprising:

a substrate;

a detection chamber disposed on said substrate and defining a volume between 1 pico-liter and 1 micro-liter;

a retention device disposed at least in part on said substrate at said detection chamber for capturing microorganisms from a flowing sample stream and retaining said microorganisms in said detection chamber;

a heater operatively connected to said substrate to heat said composition in said detection chamber; and

electrodes mounted on said substrate and disposed in communication with said detection chamber to identify AC impedance changes within said detection chamber from bacterial metabolism of said microorganisms over time.

20. The biosensor of claims 19, further comprising retention means connected to said detection chamber for retaining said microorganisms in said detection chamber.

21. The biosensor of claim 20 wherein said retention means has magnetic and/or electrical attributes to confine said microorganisms.

22. The biosensor of claim 20 wherein said retention device has electrodes including interdigitated finger parts for generating a non-uniform electric field to confine said microorganisms.

23. The biosensor of claim 22 wherein said retention device generates said non-uniform electric field periodically to confine said microorganisms at the surface of said detection chamber.

24. The biosensor of claim 20 wherein said retention means has mechanical attributes to confine said microorganisms.

25. The biosensor of claims 19, further comprising concentration means on said substrate for rapidly concentrating said microorganisms in said detection chamber, said specimen concentration means including a branching channel structure having a large inflow groove or trench and a substantially smaller channel extending from said inflow groove or trench to said detection chamber.

26. The biosensor of claim 19 wherein said electrodes have an interdigitated spacing within said detection chamber to gather bulk impedance measurements.

27. The biosensor of claim 19 wherein said electrodes are mounted on said substrate and disposed in communication with said detection chamber to identify AC impedance changes within said detection chamber from bacterial metabolism of said microorganisms over time relative to previous AC impedance values associated with said composition.